the two valve chests being removed from the central plane of the engine and inclined to each other, their axes meeting at the centre of the crank-shaft.

Fig. 38 illustrates a common type of piston valve, which can be used when the steam has a fair degree of superheat.

Pistons.—Although the types of piston and packings that have been used are exceedingly numerous, most of them have become obsolete, and it would be useless to describe them. Experience has caused the design to settle down in favour of a very simple type which is characterized by lightness, simplicity, and the absence of loose parts which may become detached during working and so cause damage. The design of a piston is governed by the consideration that the reciprocating parts should be as light as possible in order to minimize inertia effects, and the low-pressure piston is the starting-point. It is invariably of the conical type, fig. 39, either of cast or pressed steel. As it is important that the reciprocating weights should be the same for each cylinder for the purpose of giving good balancing, the high-pressure and the low-pressure pistons are made of cast iron. This ensures ample strength, and it is not necessary to consider this point in their case. It may be noted that in the case of triple-expansion engines it is hardly ever possible to get sufficient weight in the high-pressure piston. The strength of the low-pressure piston alone is therefore to be considered. There are no very satisfactory formulae available, and the designer is guided by experience in this matter. Satisfactory proportions are T = (- 0-41 and T_x = o»44T.

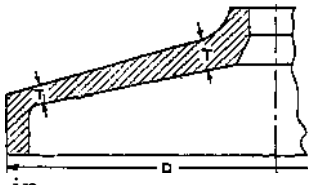

Fig. 39.—Typical Section of a piston

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The type of piston packings is first decided upon, designs involving great weight being rejected, and the thickness of metal in the wall behind the ring is fixed. The bottom of the piston is then given a slope which varies from i in 7 to i in 8. The pistons for the other cylinders are made exactly alike with regard to height of piston-rod attachment, so that the rods for all cylinders may be identical, in order to reduce

the number of spares, &c.

The packing for the low-pressure piston presents little difficulty, as, owing to the low pressure and temperature, a very simple type of ring, reinforced behind by light springs, suffices. Rings of the Ramsbottom type are usually quite satisfactory. This also applies to the intermediate cylinder of triple-expansion engines; but the piston rings of the high-pressure cylinders for both triple-expansion and compound engines, in which high pressure may be accompanied by a high temperature, may give a great amount of trouble, owing to the impossibility of preventing the steam getting behind the rings and forcing them on to the cylinder walls with an intensity equal to a high percentage of the pressure in the cylinder at the moment. This pressure causes the lubricant to be scraped away, allowing metallic contact, and much damage may be done to the bore of the cylinder. For this reason some type of restrained ring is commonly used in high-